

The Study on the Development  
of Fast Railway Transportation Corridor  
Between Shanghai and Nanjing

Shanghai Tiedao University  
Xu Rui Hua

# The Study on the Development of Fast Railway Transportation Corridor Between Shanghai and Nanjing

Gong Jiachong  
Xu Ruihua      Ji Ling

Shanghai Railway Bureau  
Shanghai Tiedao University

## Abstract

In this paper, the south - north railway transportation demand and the present situation of Huning line (from Shanghai to Nanjing) are analyzed, and the important significance and the main conditions of raising the train speed on Huning line are expounded. Based on the computer simulation, we also discuss the transportation organization plans, the transportation capacities, the stage by stage implement programs and the comprehensive social economic benefits on the condition of raising the train speed on Huning line.

## 1 INTRODUCTION

### 1.1 The Present Situation and Properties of South - North Railway Transportation in China

Railway is the national economic artery, and it is also the vanguard of national economy. In China, railway transportation is the mainstay and forerunner in the synthetic transportation system. For a long time, the railway construction has seriously lagged behind the national economic development. The railway capacity's shortage became more and more marked and cannot meet the needs of the increasing transportation demand. Railway has been a "bottle-neck" that constrains the development of national economy, which is more prominent in south - north railway transportation.

The increasing rates of transportation demand are very astonishing. In the area of East and North China, the transportation volume of passenger and goods increased at the rate of 5~7% and 8% respectively during the last 40 years, but the mileage of railway increased relative slowly. In 1952 and 1990, the mileage were 8,618 km and 19,907 km which accounted for 37.6% and 37.3% of all the country's respectively. Although the mileage had increased more than one time, the transportation volume of goods had increased more than 11 times at the same period, which were 57.57 and 6,976.77 million tones accounted for 43.6% and 47.7% of all country's transportation volume respectively. The railway capacities can only meet the less than 50% needs of demands monthly in south - north line, and even only about 30% in some sections. At the same time the quantities of passenger flows to Guangdong and East China in main line increased at double the speed, and the passenger trains have actually occupied about the half of total capacities, which competed with freight trains for capacities. In China, the yearly number of traveling by train per person is less than one time, so that it is very important to organize the passenger transportation rationally to satisfy the increase of passenger flows in south - north line. The main characters of railway transportation in south - north line are as follows:

1. The quantity of southbound goods is larger than that of northbound goods, and the ratio between them is 3:1.
2. The quantities of coal and oil account for about 60% of total southbound goods.

3. According to the forecast, the demand in 2000 will be one time more than that in 1990.

4. Because of the economic development, traveling and frequent communication of culture, the south - north passenger flows will increase on large scale and compete with freight transportation for capacity seriously.

To sum up, the shortage of the south - north railway transportation capacity is very rigorous, which will inevitably influence on the economic development in the area of East and Central South China, furthermore, in the whole national economy.

### 1.2 The Present Transportation Situation of Huning Line

The Huning district is located in the Yangtse Delta which is noted for "Golden Delta", and the local economy development is advanced situated in China. The Huning line is the major part of Jinghu line (from Beijing to Shanghai) and the main transportation corridor related with other district. At present, the capacity utilization has been in the state of saturation, and the density of passenger flow is about six times more than the average density of whole country. With the intensification of open and reform policy, the economy will develop further, and the economy and culture will communicate frequently among the cities in Huning district, which will make the passenger flows increase. At the same time, there numerous scenic and historic spots in many cities along the line such as Suzhou, Wuxi, Nanjing etc. which attract a large number of local and foreign tourists and makes tourist industry prosperous. After the five days work system been set up, many cities in the district have become the ideal places where people spend the weekend and relax themselves. So, the passenger transportation in Huning line is facing the serious challenge. But, at present time, the passenger trains in Huning line run at the level as low as alien trains did in thirty or forty years ago. Lower speed and poorer comfortability are two urgent problems to be solved. The main features of transportation in Huning line are as follows:

1. The transportation of passenger and goods among Jiangsu province, Zhejiang province, Shanghai and inland areas depends mainly on railway. The Fuliji gateway is the main "bottle neck" in Jinghu line through which the northern goods transport to the East coastal area.

2. Of all kinds of transportation methods, Huning line undertakes a large proportion of turnover quantities of passenger and goods.

3. The utilization rate of capacity has been exceeded 90%, and the density of trains is highest of all country. The increasing flexible coefficient of transportation quantity is only 0.1, which is the lowest in China. Furthermore, the transportation quantity has been increasing at the rate of 6% to 7%.

4. With the fully opened and developed in Pudong district, Shanghai, the new passenger and goods flows will mainly rely on railway.

## 2 THE SIGNIFICANCE AND PRIMARY CONDITIONS OF RAISING THE TRAIN SPEED ON HUNING LINE

### 2.1 The Significance of Raising the Train Speed on Huning Line

To transport passengers at high speed is one of the main symbols of railway modernization. All of the countries in the world regarded raising the train speed as an important strategy problem of constructing transportation corridor among the metropolitans and main economic

area, which has vast social and economic effects. So they pay more attention to raising the train speed, especially passenger train's.

Currently, our passenger trains, whatever they are called express, special express and etc., in fact, from the angle of speed can only be called ordinary trains. Except Guangshen line (from Guangzhou to Shenzheng) which is called pro-high-speed line, even on the Jinhu line, on which the passenger trains run most fast, the highest speed of passenger train is only 110 km/h and traveling speed is 86 km/h. On Huning line the shortest up passenger train's running time is 3 hours and 18 min. and average traveling speed is 92 km/h, down's is 3 hours and 31 min. and 83.6 km/h. The highest speed of freight train is 70 km/h.

With the development of the socialist market economy, the competition among different means of transport is becoming more and more drastic. In recent years, the highway and airline have developed rapidly. Because beginning later and being short of funds, the high speed railway is progressing slowly, and it is difficult for railway to satisfy the passenger's demand on speed. The railway is facing the loss of passenger flows and passenger transportation market. The situations of Shengda line (from Shengyang to Dalian, Liaoning province) and Changjiu line (from Nanchang to Jiujiang, Jiangxi province) have testified the points. The Huning highway will be completed in 1997. Then the traveling time by car will be less than 3 hours, and the competition between railway and highway could not be avoided. So, it is of great urgency to raise the train speed. The railway ministry has decided to raise the train speed in several main lines and to put into effect in Huning line at first. This decision will be advantageous to competition of railway in transportation market, promoting technology progress and enhancing the capacity, and it will be a milestone in the modern railway history.

## 2.2 The Primary Conditions of Raising the Train Speed in Huning Line

1. Better conditions of line. In Europe the highest train speed reached 140-160 km/h forty years ago, and the technology used by these railway lines was conventional. In Huning line, the condition of plane and vertical section is better, the track structure is seamless line of 60 kg/m rail, and the permitting speed has been 120 km/h. So, it is possible to raise the train speed to 140-160 km/h from the angle of track structure.

2. In the area along Huning line, the economy is flourishing, people's live level is higher, and the demand on the fast passenger train is larger.

3. The quality of workers is higher, and the foundation of management is stronger.

## 3. THE TRANSPORTATION ORGANIZATION PROGRAMS OF RAISING THE TRAIN SPEED ON HUNING LINE

### 3.1 The Programs of Fast Trains at the Initial Stage of Raising the Train Speed

At the initial stage, the fast trains can be drawn in train diagram by means of taking out the ordinary trains in the ratio of one to one. Two main methods are "replacing" and "drawing and taking out".

1. Replacing. In the current train working diagram, we can replace the ordinary trains by fast trains and make suitable adjustment on the leaving and arriving time. This method is easier, and has the less negative effects on the other trains. The replaced trains can be the trains which have the higher traveling speed among ordinary trains or tourist trains. Because the tourist

trains are very popular, these passenger flows will become the fast passenger flows naturally, and it won't result in the decreasing of passenger flows.

2. Drawing and taking out. By means of this method we can choose the periods, which have smaller influence on the other trains and better leaving and arriving time, to draw the fast train running lines and to take out ordinary train running lines in the ratio of one to one. By means of this method the moving equipment and goods capacity can be utilized better.

### 3.2 The Programs of Fast Train at the Middle and Future Stage of Raising the Train Speed

At the middle and future stage, we can adapt the balanced and centralized methods to draw fast trains in the train diagram, for the number of fast trains is large.

1. The balanced drawing method. The fast trains leaves at a certain interval from the two ending stations during the time period from 7:00 a.m. to 9:00 p.m. By means of this method the demands of passenger can be satisfied to the utmost, and the passenger flows can be attracted.

2. The centralized method. To divide the daytime into several periods (generally there are morning, afternoon and evening peak hours), the fast trains leaves centrally at the certain interval from the two ending stations in every period. The morning peak hours is from 7:00 to 10:00, afternoon's from 11:30 to 14:30 and evening's from 17:00 to 20:00. Justifying the distance, cities public traffic, airline and highway, these three peak hours could be changed. During the period of peak hours, the leaving interval of fast trains can be determined according to the quantities of fast train, the station lines, the platform and waiting condition. The long, middle and short distance fast trains leave alternately. By means of this method the passenger flows during the peak hours can be attracted and the influenced period can be reduced to the utmost.

## 4 THE CAPACITIES AFTER RAISING THE TRAIN SPEED AND STAGE BY STAGE IMPLEMENT PROGRAMS ON HUNING LINE

### 4.1 The Capacities After Raising the Train Speed on Huning Line

We calculated the capacities after raising the train speed on Huning line by means of computer simulation.

At the initial stage, the extra deduction coefficient of fast train is about 1.7, and the average quantity of influenced ordinary trains and time are 3.4 and 17.27 min. respectively, which proved that the influence of fast trains can be reduced to the minimum degree with rational organization.

At the middle and future stage, when the quantity of fast trains is small the balanced drawing method is more favorable than the centralized drawing method, on the contrary, the centralized drawing method is better. When the quantities of the fast train increase gradually to a certain extent, the capacities keep an equal trend to the present capacities basically. But with the quantities of the fast train increasing further, the capacities will be improved slightly, just because a large portion of fast trains will run by centralized drawing method in the daytime. So, there exists a suitable critical quantity of the fast trains from the angle of capacity. It should be considered to match the passenger trains with the freight trains in the speed. If the interval of two trains is curtailed to 7 min., the capacities will be improved a lot, *i.e.* with the high speed and high density the capacity can be improved to a large extent.

#### 4.2 The Stage by Stage Implement Programs of Raising the Train Speed on Huning Line

Raising the train speed on busy line can be implemented stage by stage. According to the number of fast trains, the stages can be divided into a few number stage, the increasing stage and the large number stage. There are different goals and technical organization plans at every stage. At a few number stage, the main goal is to gain the operation experience and to attract passenger flows, so it is necessary to determine the suitable price of fast train ticket, to provide comfortable and convenient service (including buying ticket, waiting and traveling) and to manage "train market". At the increasing stage, the main goal is to stabilize the passenger flows further and to achieve better economic benefits. Considering the adjustment of train diagram in whole railway, we can increase the number of fast trains steadily and raise the speed of all trains to 135 km/h gradually, which will make the foundation for raising the train speed widespread. When the all conditions are favorable, we can raise the speed of passenger and freight trains at the same time and shorten the train interval to 7 minutes, which will enhance a great quantity of railway capacity and gain better economic benefits in fierce competition of transportation market.

### 5. COMPREHENSIVE SOCIAL AND ECONOMIC BENEFITS OF RAISING THE TRAIN SPEED ON HUNING LINE

The operation costs added in raising the train speed are basically as follows: the expenditure on increased and rebuilt line, locomotives and wagons, the cost of fuel and the depreciation funds, e.g. the investment on crossings, bridges, track, roadbed and etc.. The cost related to worker and management does not change.

The economic benefit gained by raising the train speed is mainly the income of ticket. The current price of tourist train ticket from Shanghai to Nanjing is 45 RMB. After raising the train speed, the traveling time from Shanghai to Nanjing is shortened by 1.5 hours, meanwhile, and by improving ticket sale, waiting and other service, the non-traveling time will be saved by 2 hours, so the total saved time is about 3.5 hours. In Huning area, the average time value is 8.24 RMB/person-hour (according to 1994 China Statistics Almanac and Jiangsu Province Almanac), so the opportunity cost of buying ticket is about 30 RMB. According to the results of investigation, 68% passengers think that the major problem is difficulty in buying ticket, and the queuing time for buying ticket is up to 3 hours. After solving the problem of buying ticket, the price of fast train ticket can be enhanced on the basis of current price. At the same time, after raising the train speed, the railway will satisfy the new demand of passenger and divert the railway's figure, which will play an important role in the competition with Huning highway on speed, comfortableness and convenience.

On the basis of above analyses, if the quantity of the fast trains per day is 1 and the discount rate is 10%, the total adding revenue is 1.603 billion RMB after 5 years, and we can recoup capital outlay in 5 years. If the quantity of the fast trains per day is 2, the total adding revenue is 1.468 billion RMB after 2 years, and we can recoup capital outlay in 2.5 years.

The above calculation does not include the adding revenue gained by raising the freight trains. It will largely cut down the traveling time of goods and bring about vast social and economic benefits to. Because of the vast freight transportation volume on Huning line, it is

apparent that the adding value is rather large.

For a long time, the condition of the railway transportation in Jiangsu, Zhejiang and Shanghai can not meet the needs of market economy and restrict the development of economy in Shanghai and its circumference to a certain extent. After raising the train speed on the Huning line, according to the practical situation we can raise the train speed on Huhang line (from Shanghai to Hangzhou). On the basis of existent airline and highway, the fast external railway corridor can be formed, which will make the contents of transportation richer. This kind of three-dimensional transportation system will be helpful to better the investment condition, improve the attraction as well as the figure and position of Shanghai as an international city. At the same time, the comprehensive transportation system headed by Shanghai in Yangtse Delta can be established.

According to the development plan of the national economy, Shanghai's GDP will reach the level of moderate developed country. The fast railway, owing to comfortableness, fastness, cleanness, punctuality and convenience, will adapt to the demands of modernization society, and satisfy the high level consume of people living in Shanghai and its adjacent area, and benefit to improvement of people's material life and culture grade.

## 6. CONCLUSION

Based on Huning line, this paper analyses the transportation organization and comprehensive social economic benefits on the condition of raising the train speed. The main conclusions are as follows:

1. Under the condition that passenger trains and freight trains run on the same line, the fast train will influence the ordinary trains and decrease the capacities. Therefore, at the initial stage, according to the capacities and objective demands of passenger flows, a fewer fast trains should be drawn in the train diagram in the ratio of 1:1, *i.e.* draw one fast train and take out one ordinary train.

2. Raising the train speed on busy line is one of the important measures, which will be helpful to increasing the railway's competition, enhancing the capacity and promoting the progress of science and technology. According to the practical situation, it can be divided into three stages to fulfill, *i.e.* a few number stage, the increasing stage and the large number stage. In every different stage, we can use different measures of service and technical organization in order to enhance capacity greatly and gain better comprehensive social and economic benefits.

3. After raising the train speed on busy line, it is very important to use advanced technology and management in operation. So, we suggest that to establish automatic train adjusting and controlling system based on the computer.

4. Raising the train speed on busy line will bring about vast comprehensive social economic benefits and can recoup capital funds rapidly. With the quantity of fast trains increasing and the speed of all passenger trains and freight trains raising, the benefits will be more remarkable.

## REFERENCE

1. Zheng Shide, Wu Hanling. *The Organization of Railway Train Operation*. Chines Railway Publish, Beijing, China. 1990.
2. Piao Aihua, Hu Anzhou. *The Study on the Optimization of Trains Operation at Different Stages of Jinghu High Speed Railway*. *The Proc. of Conference of Transportation Organization of Jinghu High Speed Railway*, Tianjin. 1995.7
3. Ji Ling, Xu Ruihua. *The Study on the Transportation Organization on Huchang Testing Section of Jinghu High Speed Railway*. *The Proc. of Conference of Transportation Organization of Jinghu High Speed Railway*, Tianjin. 1995.7



第三届中·韩都市交  
通国际学术研讨会论

## 建设沪宁快速铁路运输通道的研究

上海铁道大学  
一九九六年六月

# 建设沪宁快速铁路运输通道的研究

龚家琮 上海铁路局  
徐瑞华 季 令 上海铁道大学

**摘要:** 本文根据南北铁路运输需求及沪宁线铁路运输的现状,论述了沪宁线列车提速的重要意义及其基本条件,探讨了列车提速的运输组织方案,通过计算机仿真对通过能力及列车提速的分阶段实施方案进行了研究,并对沪宁线列车提速后的综合社会效益进行了分析。

## 1 前言

### 1.1 中国铁路南北向运输现状及特点

铁路是国民经济的大动脉,是社会发展的先行产业。在中国,铁路运输又是综合交通运输体系中的骨干和先导,然而长期以来中国铁路建设严重滞后于国民经济发展,铁路运输能力远不能满足运输需求的增长,铁路已成为制约国民经济发展的突出薄弱环节,这点在南北向铁路运输中显得更加突出。

南北向运输需求增长速度十分惊人,客货运量40年来一直分别以5~7%和8%的速度增长,而华东、华北地区的铁路营业里程的增长速度却相对较慢,1952年为8,618km,占全国的37.6%,1990年为19,907km,占全国的37.3%,营业里程虽然增长了1倍多,但同期货运量却增长了11倍,分别为5,757万吨和697,677万吨,占全国铁路货运量的43.6%和47.7%。在目前全路铁路干线月度货物运输计划满足率为70%的条件下,南北铁路干线上月度运输计划满足率不足50%,个别区段仅30%左右。同时通往广东、华东的主要铁路干线客流成倍增长,旅客列车实际占用通过能力已占全部运输能力的一半左右,与货运争能现象严重,考虑到我国铁路人均年乘车次数不足一次,如何合理地组织旅客运输,满足客流增长也是南北铁路运输中的一个重要课题。南北铁路运输的主要特点为:

1. 南下货物比重大,与北上货物相比两者比例为3:1;
2. 南下货物中,煤炭与石油两项约占60%;
3. 南下货物的运量增长趋势,预测2000年比1990年增长1倍以上;
4. 由于城乡市场经济发展、旅游探亲和经济文化交流频繁等因素影响,南北向客流较大,与货运争能现象严重。

综上,南北向铁路运输的形势十分严峻,如不加速解决,必将严重影响在国民经济发展中占重大比例的华东、中南等地区社会经济的进一步发展,进而影响整个国民经济的发展。

### 1.2 沪宁线铁路运输现状

沪宁沿线地处长江三角洲,素有“金三角”之称。该地区人口密集,名胜古迹众多,旅游业兴旺,地区经济发展在我国处于超前地位,沪宁线是南北铁路干线京沪线的重要组成部分,也是该地区与外界联系的主要运输通道,客货运量大,行车密度高,客流密度为全路平均六倍多,通过能力利用已达饱和状态。随着改革开放的深入和经济的进一步发展,沪宁沿线城市间的政治、经济、文化交流日益频繁,人员流动日益增多。同时,沪宁沿线的

苏州、无锡、南京等地均为世界闻名的旅游胜地,吸引了众多的国内外旅游者,实行五天工作制以后,金三角的许多地方已成了一般职工周末休闲的好去处。这一切都对沪宁线的客运提出了新要求,而目前,沪宁线旅客运输基本上还停留在国外五、六十年代的水平,速度慢、舒适性较差等问题急待解决。沪宁线铁路运输具有如下的特点:

1. 铁路是江、浙、沪三省市赖以与内陆之间人员和物资的交流的主要途径。目前京沪大通道符离集口是北方物资进入华东沿海地区的主要限制口。

2. 在各种运输方式中,铁路运输承担了该地区大部分的客货运周转量。

3. 沪宁线通过能力利用率超过90%,行车密度为全国之最,运量增长的弹性系数只有0.1,为全国最低水平,目前该线承担的运量仍以6-9%的速度增长。

4. 随着上海浦东的开发开放,由于其内引外联性质,将新产生大量的客货流,在相当长一段时间内,大部分仍须由铁路运输。

## 2 沪宁线列车提速的重要意义及其基本条件

### 2.1 沪宁线列车提速的重要意义

客运高速化是铁路现代化的主要标志。世界各国都把提高铁路旅客列车速度(下称为“提速”)问题,视作建设大城市和主要经济区之间运输走廊的重大社会与经济发展战略问题,十分注重发展和提高铁路旅客列车运行速度。

我国铁路旅客列车无论是普客、直客、快客、直快、特快或直达特快,就速度而言,只能称之为普速列车。目前除广深线外,即使在旅客列车速度最高的京沪线,列车运行速度的最高值也仅为110km/h,旅行速度为86km/h,沪宁线旅客列车最短运行时间为上行3小时18分、平均旅速92km/h,下行3小时31分、平均旅速86.3km/h;货物列车最高速度为70km/h。

随着我国社会主义市场经济体制的建立和逐步完善,运输市场竞争也日趋激烈。近几年来高速公路与航空运输都有了飞速的发展,而铁路客运受高速化起步晚、资金要求高等因素的制约,发展较慢,已难以适应旅客对列车速度的要求,铁路正面临客流流失和失去客运市场的难题。沈大线、昌九线公铁竞争的结果已证明了这点,目前正在修建的沪宁高速公路预计在1997年可建成通车,届时沪宁间的公路旅行时间将在3小时以内,公铁竞争的局面不可避免。因此,提高旅客列车速度已是刻不容缓。铁道部决定在既有繁忙干线进行客货列车提速,并率先在沪宁线实行,这是少花钱、办大事,改变中国铁路面貌的一项重大举措,将有利于中国铁路走向市场、参与竞争、促进铁路科技进步和提高铁路运输能力,在中国铁路近代史上将是一个里程碑。

### 2.2 沪宁线列车提速的基本条件

1. 线路条件良好。欧洲铁路早在五六十年代旅客列车的最高速度就达140-160km/h,这些铁路均是使用常规技术,目前沪宁线平纵断面条件较好,轨道结构是60kg/m钢轨无缝线路,线路允许速度为120km/h,将速度提高至140-160km/h,从轨道结构来看没有太大的问题。

2. 沪宁沿线经济发达,人们的生活水平高,对快速旅客列车的需求大,对优质优价列车的经济承受能力强。

3. 沪宁线职工素质较好,管理基础工作较强,开行快速列车后安全管理可靠性高。

## 3 沪宁线列车提速的运输组织方案

### 3.1 提速初期快速列车开行方案的确定

在提速初期,快速列车的开行可以1:1抽线的方式铺画,具体可采用“更改车次”、“加开抽线”等方法来实现。

1. 更改车次。“更改车次”是在现行运行图中,将原有快车车次(特快、旅游、直快等)成对地更改为快速列车车次,并对其始发和终到时刻作适当的调整。该方法较为简便易行,并且对其它列车的影响程度较低,具体可以将目前旅速最高、设施最好的管内旅游列车,改为快速列车,由于旅游列车为热门车次,将其改为快速列车后,原有的大部分客流将自然地过渡为快速客流,不会因变动太大而造成客流流失。

2. 加开抽线。“加开抽线”方法是指选择影响区域小、到发点好的时间范围,铺画快速列车运行线,同时以1:1的比例,相应抽去适当的旅客列车运行线。该方法可以使得活动设备利用和货运能力等得到较大的改善。

### 3.2 提速中远期快速列车开行方案的确定

中远期快速列车开行数量增多,可采取均衡和集中的方式铺画快速列车。

1. 均衡铺画。均衡铺画是指将快速列车在白天7:00~21:00范围以一定的时间间隔均衡地从两端车站出发。该方式能最大限度地满足旅客的旅行要求,有利于吸引客流。

2. 集中铺画。集中铺画是指将快速列车每天分若干个阶段(一般为早、午、晚高峰)开行,在各阶段中分别以一定的时间间隔从两端车站出发。早高峰时间段为7:30~10:30,午高峰时间段为11:30~14:30,晚高峰时间段为17:00~20:00,视快速列车的运行距离、城市交通以及同向航空、高速公路的情况,这三个黄金时间段可能错前错后。在高峰时间带中快速列车出发的时间间隔可根据开行数量、到发线、站台、候车条件等确定,且长、中、短程快速列车交错发车。采取这一方式有利于高峰时间内最大限度吸引客流,同时可以尽量减小快速列车的影响区域,从而减少对通过能力的影响。

## 4 沪宁线列车提速的通过能力及分阶段实施方案

### 4.1 沪宁线列车提速的通过能力

我们运用计算机仿真的方法对沪宁线列车提速后的通过能力进行了仿真计算,结果表明:提速初期,快速列车的平均额外扣除系数为1.7左右,对基本图的跨局长途客车的平均影响列数和时间分别为3.4列、17.27列分。这说明提速初期通过合理的运输组织可使快速列车对既有客车和货车的影响程度降低到最小。

提速中远期,当开行数量较少时,均衡铺画方式优于集中铺画方式,而当开行数量较多时,集中铺画方式优于均衡铺画方式;当快速列车开行数量在一定范围内逐步增加时,通过能力呈与现有能力基本持平的趋势,但随快速列车开行数量的进一步增加,由于大部分客车将于白天开行,开行时间范围相对集中,能力有所提高,因此从通过能力的角度看,快速列车开行数量存在一合理的范围和临界点。客货列车的普遍提速则应考虑相互间速度的合理匹配,当列车追踪间隔时间缩短为7分钟时,通过能力可获得较大幅度的提高,换句话说,通过能力的较大提高必须通过快速度和高密度相结合才能实现。

### 4.2 沪宁线列车提速的分阶段实施方案

综上所述,我们认为该线列车提速可按少量开行期、增加开行期和普遍开行期三阶段分步实施,各阶段具有不同的目标,应根据客货运输需求、快速列车车底及机车数量和通过能力限制等因素,采用不同的技术组织措施。在少量开行期,应以取得快速列车运营经验、吸引客流为主要目标,为此可通过制定合理的快速列车票价,提供优质方便的购票、候车、乘车等旅行条件和开发经营“列车市场”等实现;在增加开行期,应以进一步稳定客流和取得良好的经济效益为主要目标,结合全路列车运行图的调整,稳步增加快速列车数量,并逐步将旅客列车的速度普遍提高至135Km/h,为旅客列车的普遍提速打下基础;在各方面条件成熟时,可一步到位同时提高客货列车的运行速度和缩短追踪间隔时间,以提高铁路运输能力和在激烈的运输市场竞争中取得较好的经济效益。

## 5 沪宁线列车提速的综合社会经济效益分析

沪宁线列车提速所增加的运营成本主要有:因提速要求而需增加和改建的线路、机车车辆等方面的支出和因提速而多消耗的燃料及相应多提的折旧费等,有关的直接人工费及相应的管理费不变。

列车提速为客运带来的经济效益主要是票价收入,沪宁线现行旅游列车票价为45元,客车提速后旅客在途旅行时间缩短了1.5小时左右,同时通过改进售票、候车等服务,约可节省非旅行时间2小时,按本地区单位时间人均国民收入价值为8.24元/人小时(据1994年中国统计年鉴和江苏省年鉴)计算,则现在购买一次票的机会成本约为30元,问卷调查结果表明,68%的旅客认为沪宁线现行列车存在的主要问题是购票难,为购票排队所需时间平均达3小时之多,节假日购票则更难,因此在解决购票难这一问题后,快速列车的票价可在现行票价的基础上适当提高。同时,沪宁线客车提速后满足了旅客的新要求,扭转了铁路的形象,在与即将建成的沪宁高速公路在速度、舒适和方便等多方面的竞争中将起到十分重要的作用。

根据上述条件,取贴现率为10%测算,在每天开行一对快速列车的情况下,5年后其增加的总收入现值约为1.603亿,用5年左右时间可收回投资额;在每天开行两对快速列车的情况下,2年后增加的总收入现值约为1.468亿,用2.5年时间就可收回投资额。

上述测算尚不包括货车相应提速增加的收入,货车提速后将大大节省货物在途时间,从而带来巨大的社会效益。在途货物的时间价值目前难以得出,但是因沪宁线货运量较大,不难看出其价值增量将是相当可观的。

较长一段时间以来,江浙沪地区的铁路运输条件远不能适应市场经济需求,在一定程度上限制着上海及周边经济的发展。以上海为中心,实现沪宁线列车提速,并从实际出发,综合考虑,带动沪杭线提速,将有利于上海对外快速交通走廊的构成,在已有航空、高速公路的基础上,再建成铁路快速通道,将使整个交通的内涵更丰富,这种立体快速交通体系的完善将有助于改善投资环境,增加上海的市场吸引力,提高上海这一国际级大都市的形象和地位。同时,沪宁、沪杭快速铁路交通的实现,可以构筑以上海为龙头的长江三角洲地区的综合交通体系和完善的大交通格局,对区域经济发展将起到强有力的支撑作用。

从国家经济发展规划分析,上海在2000年人均国民生产总值将达到30000元,达到中等以上国家水平。快速铁路运输将以其舒适、快速、洁净、准时、方便等方面的优点适应现代化社会的需要,适应上海及其周边地区人民生活水平对较高层次消费的追求,有利于人们物质生活水平的提高和文化层次的升格。

## 6 结论

本文以沪宁线为背景分析了繁忙干线列车提速运输组织和综合社会效益,主要结论如下:

1. 在既有繁忙干线客货共线运行的条件下,快速列车的开行将对既有旅客列车的运行产生不利的影响,同时也将降低货物列车通过能力。因此,以繁忙干线的运能和客流的客观要求来看,在提速初期,以1:1抽线的方式铺画少量快速列车运行线为宜。

2. 繁忙干线列车提速是铁路客运走向市场、提高通过能力和促进铁路科技进步的重要举措之一,具体实施时可根据客货运输需求、快速列车数量和通过能力等众多因素的要求,分为少量开行期、增加开行期和普遍开行期三阶段逐步实施。在不同的实施阶段可采用不同的客运服务和技术组织措施,以获得通过能力的较大提高,满足客货运输需求,并取得良好的经济和社会效益。

3. 繁忙干线列车提速后对运输组织和行车调度指挥提出了更高的要求,因此采用先进的管理手段、管理方法十分重要,建议建立基于计算机管理的列车调度行车指挥自动化系统。

4. 繁忙干线列车提速将带来巨大的综合社会效益,并能较快地收回投资,随着快速列车开行数量的增多及客货列车的普遍提速其效益将更为显著。

#### 参考文献

1. 郑时德,吴汉玲主编. 铁路行车组织. 中国铁道出版社,北京. 1990年
2. 朴爱华,胡安洲. 京沪高速铁路不同发展阶段列车运行组织优化问题的研究. 京沪高速铁路运输组织及实施对策研讨会北方交通大学论文选编. 天津. 1995年7月
3. 季令,徐瑞华,王遐昌. 京沪高速铁路沪常试验运输组织及实施对策研究. 京沪高速铁路运输组织及实施对策研讨会,天津. 1995年7月